

AMENDMENTS TO THE CLAIMS

Following is a complete set of claims as amended with this Response. This complete set of claims includes amended claims 13, 15, 16, 22-25, 31, and 34 and new claims 48-50.

1. (Withdrawn) A method of packaging a sensor device implantable in a living body, the method comprising:
  - (a) sealing an electrical conductor of the sensor device extending between proximal and distal ends in a non-conductive substrate;
  - (b) connecting an end of the electrical conductor to an external sensor on the sensor device;
  - (c) connecting a second end of the electrical conductor to a lead that is configured to connect to an implantable medical device;
  - (d) embedding the connection between the distal end of the electrical conductor and the external sensor in an insulative deposit of protective material; and
  - (e) encapsulating the external sensor, substrate, and insulative deposit of protective material in a hermetic material without interference with the lead.
2. (Withdrawn) A method of packaging as set forth in claim 1 and further comprising:
  - (f) intermediate steps (d) and (e), encapsulating the external sensor and the substrate in a layer of insulating material without interference with the lead.
3. (Withdrawn) A method of packaging as set forth in claim 2 wherein the substrate is composed of at least one of ceramic and glass.
4. (Withdrawn) A method of packaging as set forth in claim 1 wherein the external sensor is at least one of a temperature sensor and a pressure sensor.

5. (Withdrawn) A method of packaging as set forth in claim 1 wherein the pulse generator is a pacemaker.
6. (Withdrawn) A method of packaging as set forth in claim 1 wherein the pulse generator is a defibrillator.
7. (Withdrawn) A method of packaging as set forth in claim 1 wherein the hermetic material is at least one of titanium, gold, platinum, and carbon.
8. (Withdrawn) A method of packaging as set forth in claim 1 wherein the thickness of the thin film of hermetic material is in the range of about 10 nm to 0.1 mm.
9. (Withdrawn) A method of packaging as set forth in claim 2 wherein the insulating layer is parylene.
10. (Withdrawn) A method of packaging as set forth in claim 2 wherein the thickness of the layer of insulating material is in the range of about 5 nm to 0.5 mm.
11. (Withdrawn) A method of packaging as set forth in claim 2 wherein step (e) ensures the complete encapsulation of the layer of insulating material applied by step (f).
12. (Withdrawn) A method of packaging as set forth in claim 1 wherein step (c) includes the step of:
  - (f) inserting a pad of conductive material intermediate, and in electrical continuity with, the distal end of the lead and with the proximal end of the electrical conductor.

13. (Currently Amended) A pressure sensor device implantable in a living body, the pressure sensor device comprising:

an insulating substrate that defines a feedthrough region, the insulating substrate having a first outer surface and a second outer surface opposing the first outer surface, the first outer surface of the insulating substrate opposing the second outer surface of the insulating substrate;

a pressure sensor having a first outer surface in contact with the insulating substrate and a second outer surface opposing the first outer surface and a second outer surface opposing the first outer surface and a second outer surface, the first outer surface of the pressure sensor opposing the second outer surface of the pressure sensor, and the pressure sensor directly mounted on the insulating substrate such that the first outer surface of the pressure sensor is in contact with the second outer surface of the insulating substrate;

an electrical conductor received in the feedthrough region;

a bond wire connected to the electrical conductor and to the pressure sensor, wherein the bond wire is embedded in an insulative sheath;

a lead connected to the electrical conductor and configured for connection to an implantable medical device; and

a thin film of hermetic material encapsulating both the second outer surface of the pressure sensor and the first outer surface of the insulating substrate, an inner surface of the thin film directly contacting the second outer surface of the pressure sensor and an the first outer surface of the insulating substrate to form a voidless encapsulation of the pressure sensor and the insulating substrate.

14. (Previously Cancelled)

15. (Currently Amended) The implantable sensor device as set forth in claim

13

wherein the insulating substrate is composed of at least one of ceramic and glass.

16. (Currently Amended) The implantable sensor device as set forth in claim

13

wherein the pressure sensor pressure is an integrated pressure sensor and temperature sensor unit.

17. (Original) The implantable sensor device as set forth in claim 13

wherein the hermetic material is at least one of titanium, gold, platinum, and carbon.

18. (Original) The implantable sensor device as set forth in claim 13

wherein the thickness of the thin film of hermetic material is in the range of about 10 nm to 0.1 mm.

19. (Previously Cancelled)

20. (Original) The implantable sensor device as set forth in claim 13 and further comprising:

a pad of conductive material intermediate, and in electrical continuity with, the lead and with the electrical conductor.

21. (Previously Presented) The implantable sensor device as set forth in claim 13

wherein the lead is an implantable lead to pace and sense a heart.

22. (Currently Amended) An implantable medical device comprising:

a pulse generator;

an implantable lead having a distal portion and a proximal portion, the proximal portion connected to the pulse generator; and

a pressure sensor device connected to the implantable lead, the pressure sensor device comprising:

an insulating substrate that defines a feedthrough region, the insulating substrate having a first outer surface and a second outer surface, and the first outer surface of the insulating substrate opposing the second outer surface of the insulating substrate;

a pressure sensor having a first outer surface in contact with the insulating substrate and a second outer surface opposing the first outer surface and a second outer surface, the first outer surface of the pressure sensor opposing the second outer surface of the pressure sensor, and the pressure sensor mounted directly on the insulating substrate such that the first outer surface of the pressure sensor is in contact with the second outer surface of the insulating substrate;

an electrical conductor received in the feedthrough region, the electrical conductor electrically coupled to the implantable lead;

a layer of insulating material encapsulating both the pressure sensor and the insulating substrate, an inner surface of the layer of insulating material directly contacting an the first outer surface of the insulating substrate and the second outer surface of the pressure sensor to form a voidless encapsulation of the pressure sensor and the insulating substrate; and

a thin film of hermetic material encapsulating the layer of insulating material, an inner surface of the thin film of hermetic material directly contacting an outer surface of the layer of insulating material to form a voidless encapsulation of the layer of insulating material.

23. (Currently Amended) The implantable medical device as set forth in claim 22 and further comprising:

a bond wire connecting the electrical conductor to the pressure sensor; and  
an insulative deposit of protective material embedding the bond wire;

wherein the layer of insulating material encapsulates the insulative deposit of protective material.

24. (Currently Amended) The implantable medical device as set forth in claim  
22

wherein a proximal end of the pressure sensor device is connected to the distal  
end of the implantable lead.

25. (Currently Amended) The implantable medical device as set forth in claim  
22

wherein the insulating substrate is composed of at least one of ceramic and  
glass.

26. (Previously Presented) The implantable medical device as set forth in  
claim 22

wherein the pressure sensor is an integrated pressure sensor and temperature  
sensor unit.

27. (Previously Presented) The implantable medical device as set forth in  
claim 22

wherein the hermetic material is at least one of titanium, gold, platinum, and  
carbon.

28. (Previously Presented) The implantable medical device as set forth in  
claim 22

wherein the thickness of the thin film of hermetic material is in the range of about  
10 nm to 0.1 mm.

29. (Previously Presented) The implantable medical device as set forth in  
claim 22

wherein the thickness of the layer of insulating material is in the range of about  
5.0 nm to 0.5 mm.

30. (Previously Presented) The implantable medical device as set forth in claim 22

wherein the implantable medical device is a cardiac pacemaker; and wherein the implantable lead paces and senses a heart.

31. (Currently Amended) An implantable medical device comprising:

a pulse generator;

an implantable lead having a distal portion and a proximal portion, the proximal portion connected to the pulse generator; and

a pressure sensor device connected to the implantable lead, the pressure sensor device comprising:

an insulating substrate that defines a feedthrough region, the insulating substrate having a first outer surface and a second outer surface, and the first outer surface of the insulating substrate opposing the second outer surface of the insulating substrate;

a pressure sensor having a first outer surface in-contact with the insulating substrate and a second outer surface opposing the first outer surface and a second outer surface, the first outer surface of the pressure sensor opposing the second outer surface of the pressure sensor, and the pressure sensor directly mounted on the insulating substrate such that the first outer substrate of the pressure sensor is in contact with the second outer surface of the insulating substrate;

an electrical conductor received in the feedthrough region, the electrical conductor electrically coupled to the implantable lead; and

a thin film of hermetic material encapsulating both the insulating substrate and the pressure sensor, an inner surface of the thin film of hermetic material directly contacting an the first outer surface of the insulating substrate and the second outer surface of the pressure sensor to form a voidless encapsulation of the insulating substrate and the pressure sensor.

32. (Previously Presented) The implantable medical device as set forth in claim 31 and further comprising:

a bond wire connecting the electrical conductor to the pressure sensor; and an insulative deposit of protective material embedding the bond wire;

wherein the thin film of hermetic material encapsulates the insulative deposit of protective material.

33. (Previously Presented) The implantable medical device as set forth in claim 31

wherein a proximal end of the pressure sensor device is connected to the distal end of the implantable lead.

34. (Currently Amended) The implantable medical device as set forth in claim 31

wherein the insulating substrate is composed of at least one of ceramic and glass.

35. (Previously Presented) The implantable medical device as set forth in claim 31

wherein the pressure sensor is an integrated pressure sensor and temperature sensor unit.

36. (Previously Presented) The implantable medical device as set forth in claim 31

wherein the hermetic material is at least one of titanium, gold, platinum, and carbon.

37. (Previously Presented) The implantable medical device as set forth in claim 22

wherein the thickness of the thin film of hermetic material is in the range of about 10 nm to 0.1 mm.

38. (Previously Presented) The implantable medical device as set forth in claim 22

wherein the implantable medical device is a cardiac pacemaker; and

wherein the implantable lead paces and senses a heart.

39. (Previously Presented) The implantable sensor device as set forth in claim 13

wherein the thin film of hermetic material in contact with the second outer surface of the pressure sensor is exposed to the living body, and wherein the second outer surface of the pressure sensor and the thin film of hermetic material in contact with the second outer surface of the pressure sensor deflect in response to pressure changes in the living body.

40. (Previously Presented) The implantable sensor device as set forth in claim 13

wherein the second outer surface of the pressure sensor comprises a diaphragm to measure pressure, wherein the thin film of hermetic material is in contact with the diaphragm, wherein the thin film of hermetic material in contact with the diaphragm is exposed to the living body, and wherein the diaphragm and the thin film of hermetic material in contact with the diaphragm deflect in response to a change in pressure in the living body.

41. (Previously Presented) The implantable sensor device as set forth in claim 13

wherein the pressure sensor is a capacitive pressure sensor, wherein the second outer surface of the pressure sensor comprises a diaphragm and the thin film of hermetic material is in contact with the diaphragm, wherein the thin film of hermetic material in contact with the diaphragm is exposed to the living body, and wherein the diaphragm and the thin film of hermetic material in contact with the diaphragm are defectively responsive to pressure changes in the living body.

42. (Previously Presented) The implantable medical device as set forth in claim 22

wherein the thin film of hermetic material in contact with the second outer surface of the pressure sensor is exposed to a living body, and wherein the second outer surface of the pressure sensor, the layer of insulating material, and the thin film of hermetic material deflect in response to pressure changes in the living body.

43. (Previously Presented) The implantable medical device as set forth in claim 22

wherein the second outer surface of the pressure sensor comprises a diaphragm to measure pressure in a living body, wherein the layer of insulating material is in contact with the diaphragm, wherein the thin film of hermetic material is exposed to the living body, and wherein the diaphragm, the layer of insulating material, and the thin film of hermetic material deflect in response to a change in pressure in the living body.

44. (Previously Presented) The implantable medical device as set forth in claim 22

wherein the pressure sensor is a capacitive pressure sensor, wherein the second outer surface of the pressure sensor comprises a diaphragm and the layer of insulating material is in contact with the diaphragm, wherein the thin film of hermetic material in contact with the layer of insulating material is exposed to a living body, and wherein the diaphragm, the layer of insulating material, and the thin film of hermetic material is deflectively responsive to pressure changes in the living body.

45. (Previously Presented) The implantable medical device as set forth in claim 31

wherein the thin film of hermetic material in contact with the second outer surface of the pressure sensor is exposed to a living body, and wherein the second outer surface of the pressure sensor and the thin film of hermetic material in contact with the second outer surface of the pressure sensor deflect in response to pressure changes in the living body.

46. (Previously Presented) The implantable medical device as set forth in claim 31

wherein the second outer surface of the pressure sensor comprises a diaphragm to measure pressure in a living body, wherein the thin film of hermetic material is in contact with the diaphragm, wherein the thin film of hermetic material in contact with the diaphragm is exposed to the living body, and wherein the diaphragm and the thin film of hermetic material in contact with the diaphragm deflect in response to a change in pressure in the living body.

47. (Previously Presented) The implantable medical device as set forth in claim 31

wherein the pressure sensor is a capacitive pressure sensor, wherein the second outer surface of the pressure sensor comprises a diaphragm and the thin film of hermetic material is in contact with the diaphragm, wherein the thin film of hermetic material in contact with the diaphragm is exposed to a living body, and wherein the diaphragm and the thin film of hermetic material is deflectively responsive to pressure changes in the living body.

48. (New) The implantable sensor device as set forth in claim 13

wherein the thin film of hermetic material is a continuous thin film encapsulating both the second outer surface of the pressure sensor and the first outer surface of the insulating substrate.

49. (New) The implantable medical device as set forth in claim 22

wherein the thin film of hermetic material is a continuous thin film encapsulating both the second outer surface of the pressure sensor and the first outer surface of the insulating substrate.

50. (New) The implantable medical device as set forth in claim 31 wherein the thin film of hermetic material is a continuous thin film encapsulating both the second outer surface of the pressure sensor and the first outer surface of the insulating substrate.